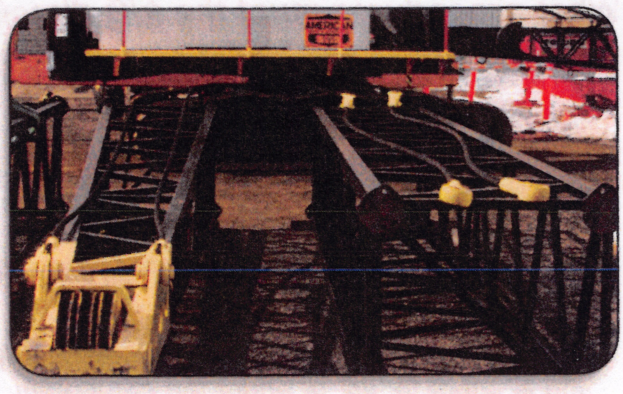
Module 16
Boom Assembly & Disassembly



Learning Objectives

By the end of this section, you will:

1. Know what should be checked during a boom and jib inspection.
2. Know the 5 steps for installing counterweights.
3. Know proper boom assembly and associated safety issues.
4. Know how to install a jib.
5. Understand the 6 key steps to disassemble a boom safely.

OSHA Regulations

While at a work station on any part of the equipment (including the boom, of any type), except when the employee is at or near draw-works (when the equipment is running), in the cab, or on the deck.

OSHA 1926.1423 (e)(2) & (f)

For assembly/disassembly work the employer must provide and ensure the use of fall protection equipment for employees who are on a walking/working surface with an unprotected side or edge more than 15 feet above a lower level, except when the employee is at or near draw-works (when the equipment is running), in the cab, or on the deck.

OSHA 1926.1423 (e)

What are the qualifications for the A/D Director?

OSHA 1926.1404(a) 1926.1404(b) 1926.1404(c)

» Assembly/disassembly must be directed by a person who meets the criteria for both a competent person and a qualified person, or by a competent person who is assisted by one or more qualified persons ("A/D director").

» Where the assembly/disassembly is being performed by only one person, that person must meet the criteria for both a competent person and a qualified person. For purposes of this standard, that person is considered the A/D director.

» The A/D director must understand the applicable assembly/disassembly procedures.

» The A/D director must review the applicable assembly/disassembly procedures immediately prior to the commencement of assembly/disassembly unless the A/D director understands the procedures and has applied them to the same type and configuration of equipment (including accessories, if any).

What procedures must the A/D director ensure the crew understands?

- Their tasks.
- The hazards associated with their tasks.
- The hazardous positions/locations that they need to avoid.

OSHA 1926.1404(d)(1)

What are the crew member responsibilities if they go out of view of the operator?

- Before a crew member goes to a location that is out of view of the operator and is either in, on, or under the equipment, or near the equipment (or load) where the crew member could be injured by movement of the equipment (or load), the crew member must inform the operator that he/she is going to that location.

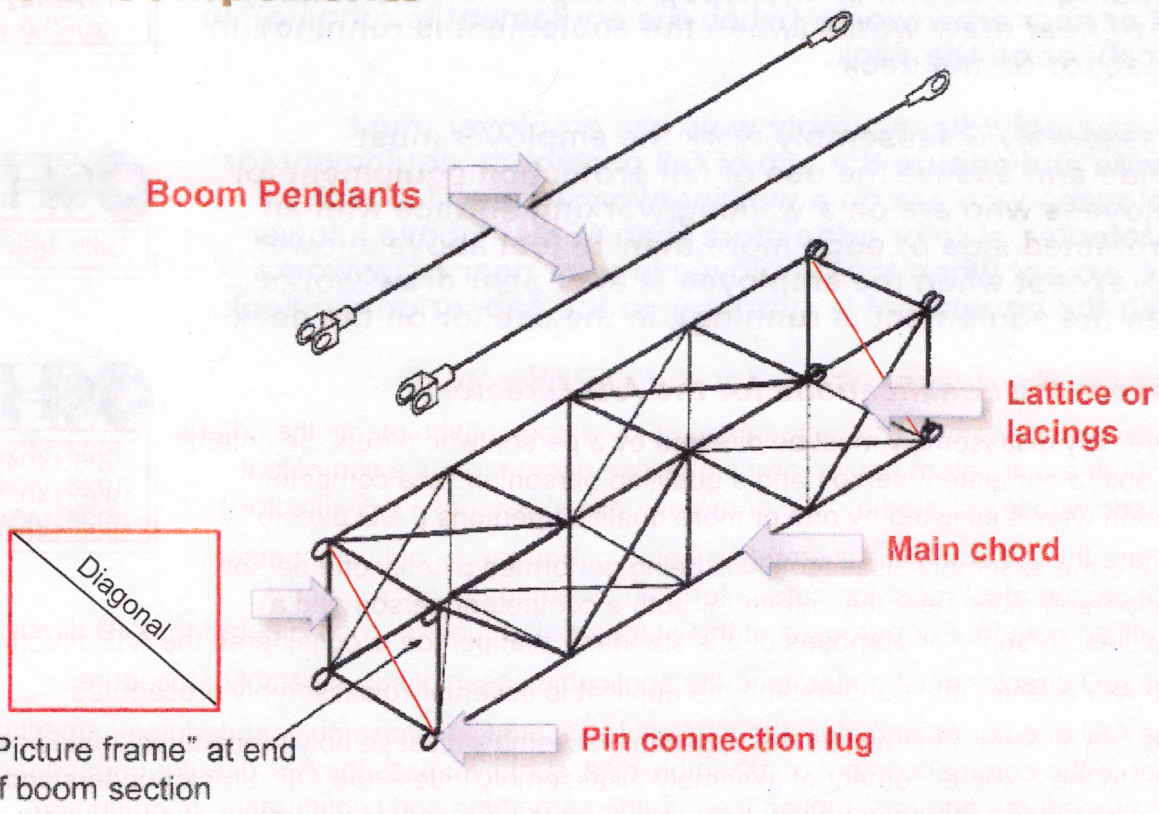
OSHA 1926.1404(e)(1)

What are the operator's responsibilities?

- Where the operator knows that a crew member went to a location covered by paragraph (e)(1) of this section, the operator must not move any part of the equipment (or load) until the operator is informed in accordance with a pre-arranged system of communication that the crew member is in a safe position.

OSHA 1926.1404(e)(2)

Boom Components



Pre-installation Inspection

Inspection of boom and jib components is critical.

Performance of components is dependent upon their being in perfect working condition to meet rating standards.

Most boom damage occurs during assembly, disassembly, loading, and unloading.

Boom and jib components are susceptible to damage during transportation and assembly and disassembly.

Boom and jib configuration must comply with the specifications in the crane manual.

What are important elements within the configuration specifications to consider?

» Length and type of boom sections.
» Sequence for boom section assembly.
» Pendant length, diameter, and installation sequence.
» Placement of pendant spreaders.
» Location of mid-point suspensions.

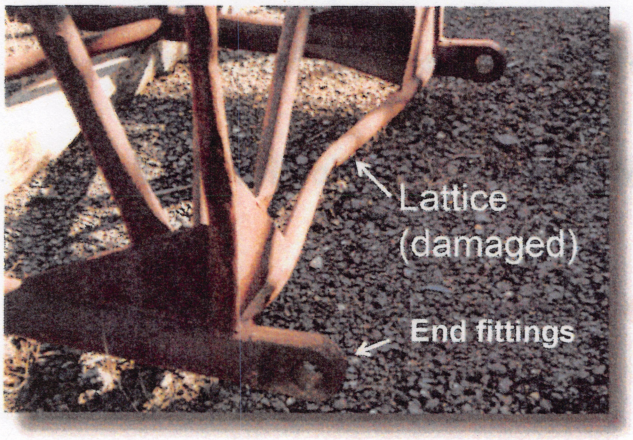
What should be checked during a boom and jib inspection?

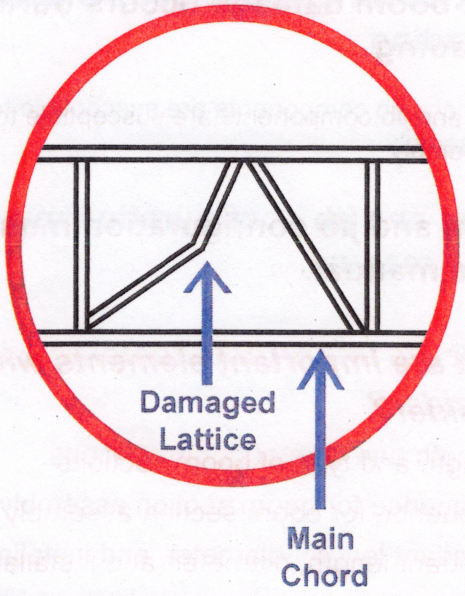
» Check all lattice members for damage or breakage.
» Check boom and jib main chords for damage or bending.
» Check all welded joints for cracks and corrosion.
» Check that proper pins and keepers are supplied.
» Check all sheaves for condition and operation.
» Sheave axles for fleeting sheaves should be clean and lubricated.

Structural damage to chords or lattice members can result in critical loss of strength.

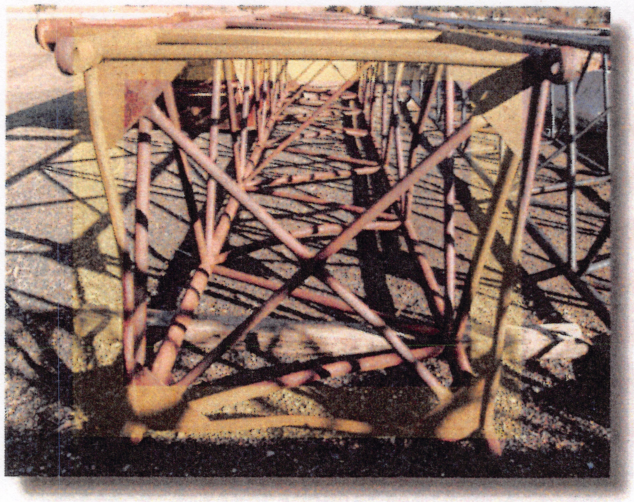
If a chord is even slightly damaged or bent, don't use it. Chords are so vital to the strength of the boom that it is not practical to attempt repairs.

Never use a boom section with a bent lattice member; unless permitted by the manufacturer.





Check the "picture frame" and welds.



Check end fittings for cracks. The picture frame must be square. Welds can be the initiation point for cracks.

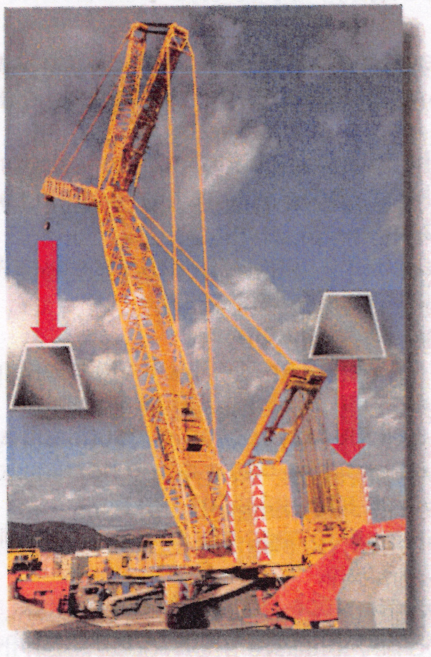
Inspecting A-frame, gantry, live mast and equalizer assembly.

Require inspection because they are an integral part of the load handling system.

Counterweight Installation

The purpose of the counterweight is to offset or balance the weight of the boom and the load being lifted.

Counterweights help ensure crane stability.



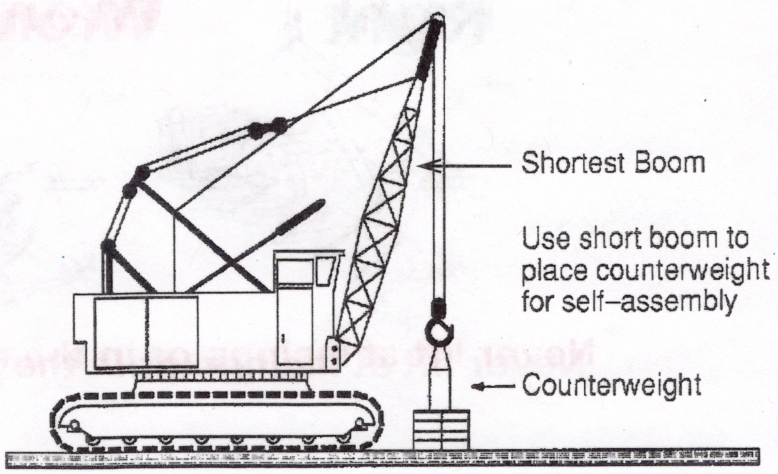
Counterweight can be lifted from flatbed truck or rail car by its own crane.

Counterweight shall be assembled per the manufacturer's specifications.

Counterweight should always be placed on adequate blocking.

Boom tip section can be connected to boom heel section to lift counterweight.

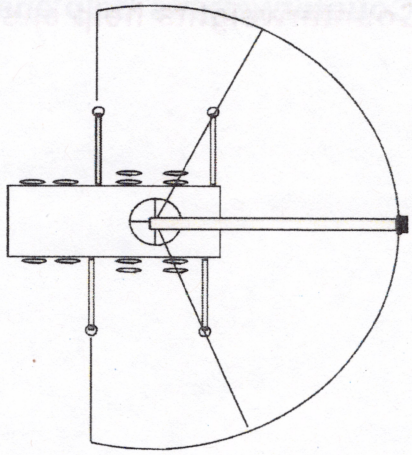
Boom assembly procedures should be followed for connecting tip section.



Boom Assembly

Boom assembly must follow manufacturer's specified guidelines.

Assemble over the quadrant with the highest stability.

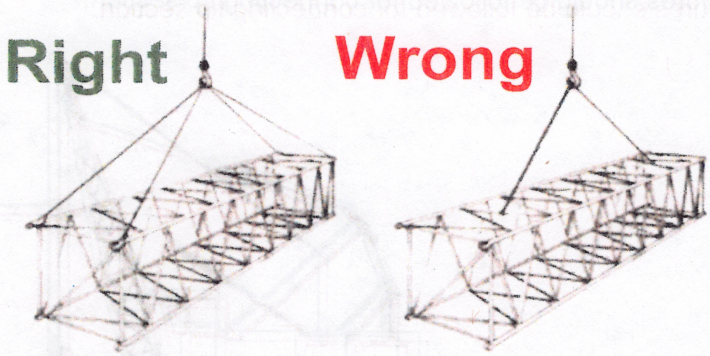


1. Level the crane - if equipped with outriggers, extend all outrigger beams fully and extend outrigger jacks until the crane is level and tires are off the ground.
2. Check the amount of counterweight required in the load chart. Check also to ensure that enough counterweight is installed to lift the boom off the ground.
3. Rotate the upper works to face over the rear or in the quadrant with the highest capacity.
4. Set the swing brake.
5. Fully extend the gantry, if the crane has a live mast, check the load chart to see if it must be used.
6. Install the butt section of boom and attach the pendants.
7. Maneuver the crane or the next insert to align with the butt section and install the top pins.
8. Boom up to align the bottom boom pins and install bottom boom pins.
9. Repeat steps 7 & 8 until all sections are installed.
10. Do not cantilever more boom than the manufacturer's recommendation.
11. Once all sections are installed, remove the pendants from the cantilever point and attach to the point section.

Truck cranes must erect booms with all outriggers extended and set.

Crawler cranes and truck cranes use same basic installation procedures.

Boom sections should be lifted by connecting fittings or designated points to manufacturer's procedures.



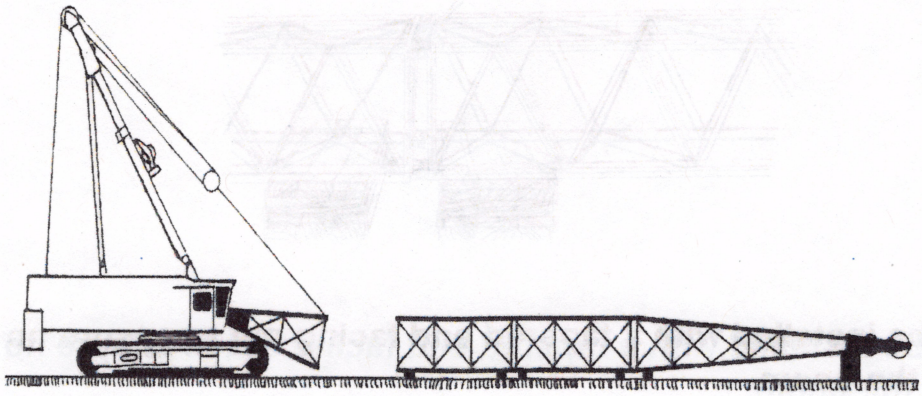
Never lift at lacings or in the middle of chords

When possible, synthetic web slings should be used.

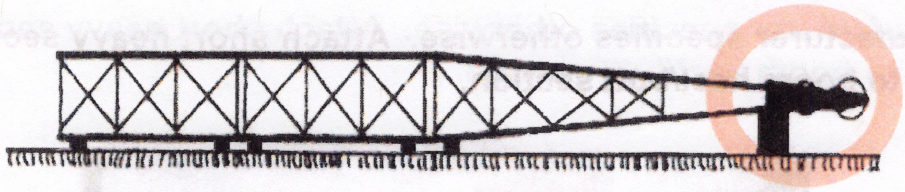
Unless manufacturer specifies otherwise. Attach short heavy sections of boom close to boom heel/butt section.

Connect remaining boom sections after attaching counterweight according to the manufacturers' specifications.

Remaining boom sections can be assembled on ground.



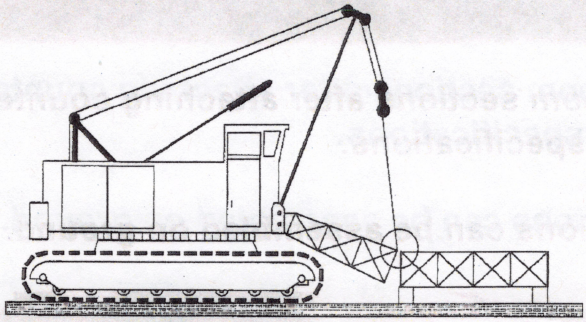
Pendant lines must be kept behind boom sections being connected.



Boom tip should be blocked to protect sheave guards.

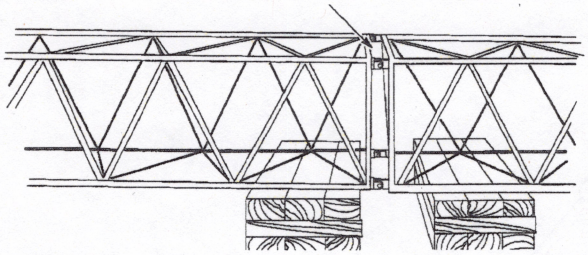
Boom sections should be pulled together or placed to line up upper pin holes.

Top pins should be inserted using cotter pins as retainers.

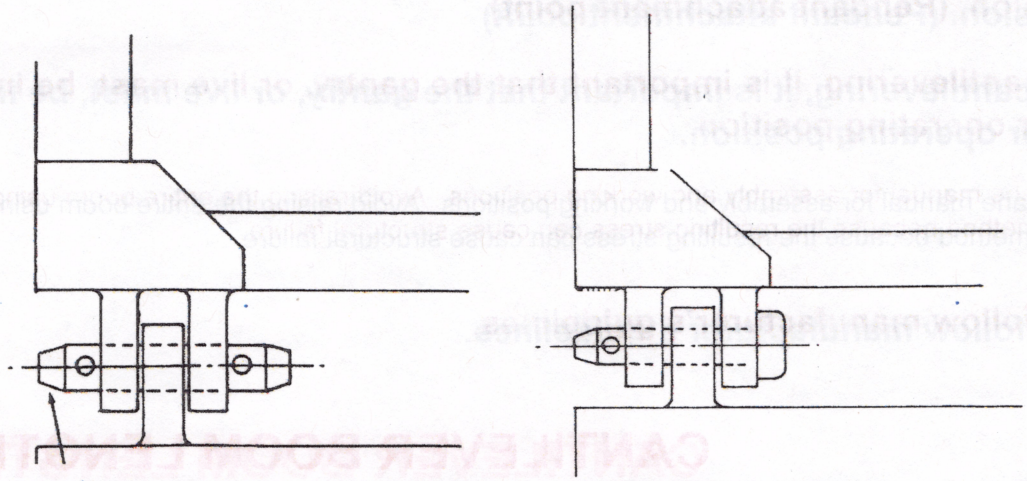


Boom up until bottom connection points line up and then install pins.

If using an assist crane, attach slings to the heel section at the connection point. Before engaging the boom hoist, check that the boom hoist line is taut and properly aligned on the drum.



Pins should be installed with a tapered end facing out to ensure no one works under the boom.



Boom pin tapered at both ends

Boom pin tapered at one end

Position boom pins to allow cotter pins to be placed on the outside of the boom.

Boom sections should be positioned in a manner as not to force boom pins into connections:

- Should insert with a moderate amount of force
- Damaged pins should be replaced
- Pins with mushroomed ends typically indicate previous use with incompatible boom connection
- Design of pin and force required to insert them can cause damage to boom connections, especially when not properly aligned

Pin boom section pendants to tip of boom and connect to gantry pendants.

Design of pin and force required to insert them can cause damage to boom connections, especially when not properly aligned.

Boom up slightly and reeve load blocks.

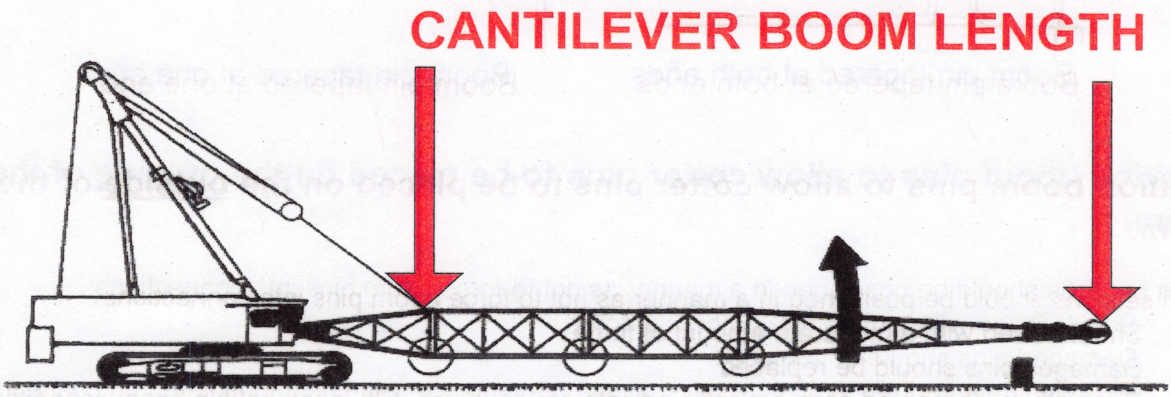
Raise boom slowly in one continuously smooth motion.

Cantilever length is the amount of boom projected beyond the point of suspension. (Pendant attachment point)

During cantilevering, it is important that the gantry, or live mast, be in the raised or operating position.

Refer to crane manual for assembly and working positions. Avoid raising the entire boom using the cantilever method because the resulting stress can cause structural failure.

Always follow manufacturer's guidelines.



Jib/Extension Assembly

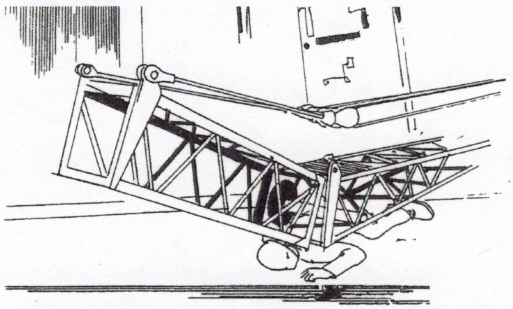
Jibs/extensions should be installed according to the crane manufacturer's manual.

Ensure the correct backstay length is used for the desired amount of jib offset.

On new types of jibs, a specific length of backstay can be inserted to provide the exact degree of offset. On older types of jib assemblies, the offset is set by adjusting the position of the wedge socket at the termination point of the jib backstay anchor until the desired amount of offset is obtained.

Boom Disassembly

Avoid climbing under or through boom to install or remove pins.

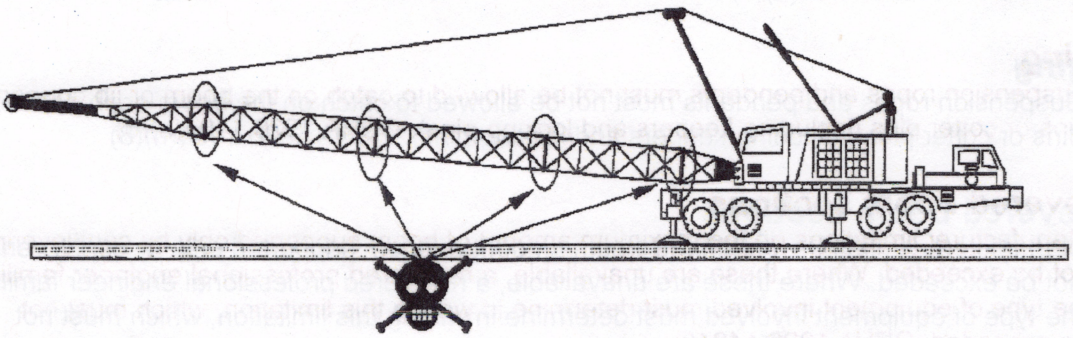


This can be the result. Never have any part of your body under the boom during disassembly!

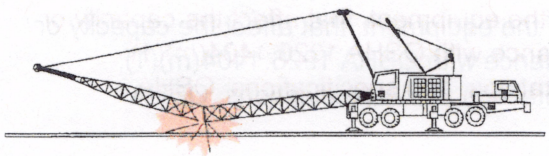
Case Study

In March 2008, an adult male (the victim) sustained fatal injuries when the crane boom he was disassembling buckled and crushed him. The truck-mounted lattice boom crane belonged to the owner of a construction company (the owner), who was a friend of the victim. The boom was 55 feet long and composed of four sections: a base (15 feet), boom extension I (20 feet), boom extension II (10 feet) and a tip with the hook (10 feet). Adjacent sections were connected with eight bolts and four connecting pins. With the pendants (hoist cables) attached to the upper end or tip of the boom, the owner and the victim lowered the boom until the tip was approximately 4 ½ feet above the ground. According to the owner, no connecting pins were to be removed until the pendants were moved from the tip to extension II and the tip section was cantilevered. The victim started removing the bolts while the owner was disassembling the hook block assembly near the tip end. In addition to removing the bolts, the victim also removed four lower connecting pins while positioning himself under the boom: two between the tip and extension II and two between extensions I and II. As the victim drove the last pin out with a 12-pound sledgehammer, the boom buckled and fell on him.

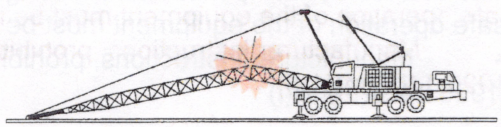
DANGER!



Remove pins in correct order!



If lower pins located between the pendant attachment points and the crane are removed, the boom will jackknife down when the last pin is pulled.



If a set of top pins located between the pendant attachment point and the crane is removed the boom will jackknife up.

Extreme caution should be exercised when dismantling boom types that require installation of cotter pins on the inside of boom to avoid pendant line snagging.

Boom should be lowered until horizontal with ground.

OSHA®

Blocking material

- The size, amount, condition and method of stacking the blocking must be sufficient to sustain the loads and maintain stability. OSHA 1926.1404(h)(2)

Proper location of blocking

- When used to support lattice booms or components, blocking must be appropriately placed to (OSHA 1926.1404(h)(3):
  - Protect the structural integrity of the equipment. OSHA 1926.1404(h)(3)(i)
  - Prevent dangerous movement and collapse. OSHA 1926.1404(h)(3)(ii)

Boom and jib pick points

- The point(s) of attachment of rigging to a boom (or boom sections or jib or jib sections) must be suitable for preventing structural damage and facilitating safe handling of these components. OSHA 1926.1404(h)(5)

Stability upon pin removal

- The boom sections, boom suspension systems (such as gantry A-frames and jib struts), and components must be rigged or supported to maintain stability upon the removal of the pins. OSHA 1926.1404(h)(7)

Snagging

- Suspension ropes and pendants must not be allowed to catch on the boom or jib connection pins or cotter pins (including keepers and locking pins). OSHA 1926.1404(h)(8)

Cantilevered boom sections

- Manufacturer limitations on the maximum amount of boom supported only by cantilevering must not be exceeded. Where these are unavailable, a registered professional engineer familiar with the type of equipment involved must determine in writing this limitation, which must not be exceeded. OSHA 1926.1404(j)

Components and configuration

- The selection of components, and configuration of the equipment, that affect the capacity or safe operation of the equipment must be in accordance with OSHA 1926.1404(m)(1):
  - Manufacturer instructions, prohibitions, limitations, and specifications. OSHA 1926.1404(m)(1)(i)

Post-assembly inspection

- Upon completion of assembly, the equipment must be inspected. (OSHA 1926.1404(m)(2))

Boom sections should be secured to trailer by boom pin attachment points.

Boom sections being secured for transport should not have lines, wire ropes or chains run over boom chords or around lacings.

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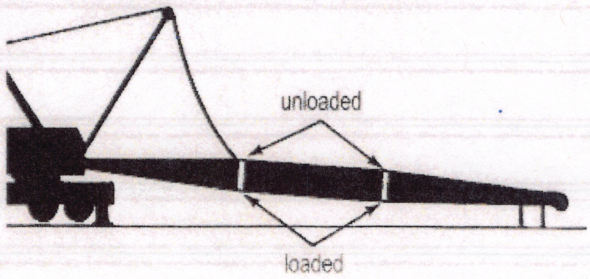
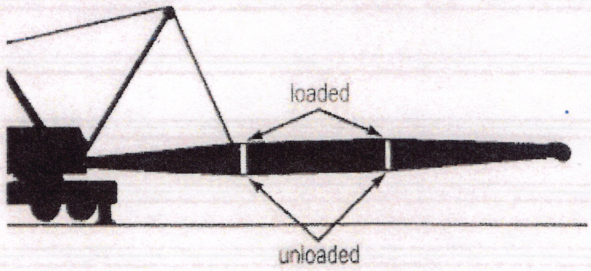
CAUTION:
Removal of loaded pins will result in boom collapse.

The load on the boom pins will change as the boom is lowered or raised from the ground.





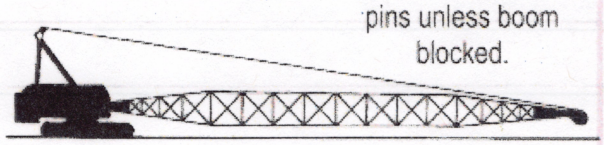
2 WORKING AROUND BOOMS

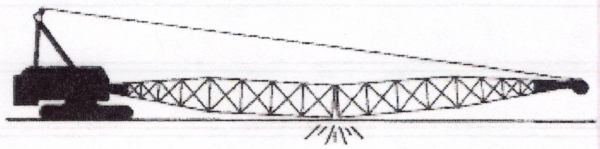
Gantry must be in raised position

Don't work under or put any part of the body under the boom at any time.

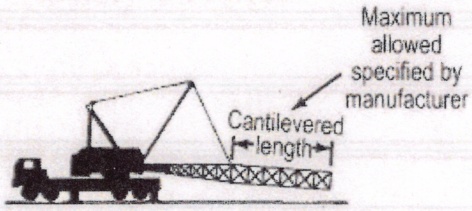
PIN REMOVAL

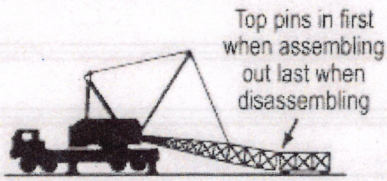
Don't remove ANY pins unless boom blocked.



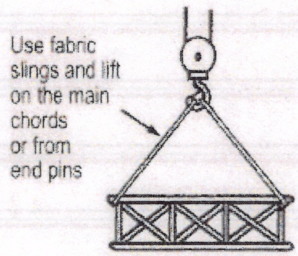


3 USE OF LIVE MAST

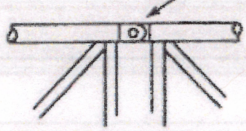




RIGGING BOOM SECTIONS



INSERTING PINS



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